

Memorandum to File

July 16, 1967

Conversation with James F. Crow.

He plans to visit Stanford on sabbatical between January 15 and May 1 next year. The subject of principal interest may be the application of artificial intelligence to genetics, as an extension of the DENDRAL project. A second topic may be the interrogation of the Census data file, but it is not clear for exactly what purpose. Conceivably these two projects might be combined.

Our first task was to try to define the simplest, yet still useful, area of genetics for heuristic formulation. What emerged after a few minutes' conversation was the automated genetic counselor. This machine would be given a pedigree or group of pedigrees as input data, and would be triggered to induce the most effective hypotheses of genetic transmission to account for them. We might use Newton MORTON's Segran program as an analog of the predictor of the DENDRAL system. Whereas at first the hypothesis generation would be quite rote and would consist of postulating an arbitrary number of genes, be they dominant or recessive, and with various interactions and penetrants, it becomes obvious that this unfiltered generator would correspond to unfiltered DENDRAL. We now have the question of automating that judgment, such as is used by the human geneticist to infer from the data which lines of hypothesis are the most plausible, and which lines do not even deserve exhaustive consideration. In a further application of the automated counselor, the system should have a good deal of a priori information with respect to the modes of inheritance and empirical risk of a number of explicit conditions, and use these as plausibility criteria, much as the GOODLIST of DENDRAL. Finally, the

mechanized system could be used for a more systematic collection of empirical risk data from existing pedigrees, and for using more complex contingencies in making predictions on an empirical risk basis.

Finally, there can be a part of the system analogous to the symbiotic aspects of DENDRAL for collecting information from a patient at input and for communicating to him at output. Possible advantages of an automatic system would be the explicit separation of informative and psychotherapeutic functions of the physician. With a counseling machine at his disposal it is also conceivable that genetic counseling could be made available to a much wider reach of physicians than is now the case. The system could have built-in interrogation to try to extract the maximum possible useful family history. Such a system should of course be well integrated with multiphasic screening and whatever else is done on an automated basis, but in many respects it might be much the most productive automation of the clinical process that could be easily undertaken at the present time.

Consider the merits of incorporating this idea into a proposal for an NIH grant.